AMENDMENTS TO THE SPECIFICATION

Please replace the paragraphs beginning at page 3, line 2 and ending at page 15, line 12 with the following amended paragraphs:

Therefore, in view of the above-described current state, ~~it is a problem~~ embodiments of the invention ~~to~~ provide an apparatus, a program and a method of ~~enabling to design optimum~~ easily designing an optimal wiring structure ~~wirings easily~~ without depending on the skill of a designer~~, its apparatus and its program~~ by ~~regarding~~ representing the~~a~~ wiring structure as an elastic body and an elastic-plastic body and applying a finite element method thereto.

~~In order to solve the aforesaid object, the invention~~ One such embodiment is characterized by ~~having~~ performing the following ~~arrangement~~method.

~~(1)~~ ——A method of ~~assisting a wiring~~ designing ~~of~~ a wiring structure includes ~~comprising~~ the steps of:

~~regarding~~ representing the wiring structure ~~constituted by a plurality of pieces of line streak members~~ as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled ~~with~~ to each other;

applying information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as a predetermined condition ~~to~~ for a finite element method;

calculating a predicted shape of the displaced wiring structure such that the predetermined condition is satisfied; and

outputting the calculated predicted shape.

~~(2)~~ The ~~method according to (1), wherein the~~ calculating step calculates the predicted shape where the wiring structure is forcibly displaced so as to satisfy the predetermined condition.

~~(3) The method according to (1), wherein~~

~~information~~ Information concerning a change in the shape characteristic, the material characteristic and the constraining condition is provided to the outputted predicted shape,

a new predicted shape of the forcibly displaced wiring structure is calculated again by utilizing the finite element method, and

the new predicted shape is output~~ted~~ again to enable ~~to verify~~ verification of an optimum shape of the wiring structure.

~~(4) The method according to (1), wherein~~

~~the~~ The wiring structure ~~is~~ can be a wire harness wired to a vehicle,

the constraining condition can be ~~is~~ defined by coordinates of respective apexes of the plurality of beam elements and degrees of freedom at the respective apexes,

the shape characteristic can be~~is~~ defined by a sectional area and a length of the beam element of the wiring structure, and

the material characteristic ~~is~~ can be defined by a moment of inertia, a polar moment of inertia, a density and a longitudinal modulus of elasticity and a transverse modulus of elasticity of the beam element.

~~(5) The method according to (1), wherein~~

~~in~~ In the calculating step, strain and stress of the wiring structure can be ~~are~~ calculated and

in the outputting step, the calculated strain and stress can be ~~are~~ output~~ted~~ together with the calculated predicted shape.

~~(6) The method according to (5), wherein the~~ The calculated strain and stress ~~are~~ can be displayed in multicolor in accordance with values of the strain and stress.

~~(7) The method according to (5), wherein~~

~~in~~ In the calculating step, reaction force and moment produced at a constraining point of the wiring structure can be ~~are~~ calculated, and

in the outputting step, the calculated reaction force and moment ~~are~~ can be output~~ted~~ together with the calculated strain, stress and predicted shape.

~~(8) The method according to (1), wherein~~

~~in the calculating step, reaction force and moment produced at a constraining point of the wiring structure are calculated, and~~

~~in~~ In the outputting step, the calculated reaction force and moment can be~~are~~ output~~ted~~ together with the calculated predicted shape.

~~(9) The method according to (8), wherein the~~ The calculated reaction force and moment can be ~~are~~ displayed by arrow marks.

~~(10) The method according to (1), wherein~~

~~in~~ In the calculating step, deformation states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition can be~~are~~ successively calculated, and

in the outputting step, the calculated deformation states of the wiring structure can be ~~are~~ successively outputted.

~~(11) The method according to (10), wherein the~~ The deformation states of the wiring structure when predetermined force is applied to a predetermined portion of the wiring structure ~~are~~ can be successively calculated and outputted.

~~(12)~~ According to another embodiment, a~~A~~ method of assisting a wiring design of a wiring structure includes ~~comprising~~ the steps of:

representing ~~regarding~~ the wiring structure ~~constituted by a plurality of pieces of line streak members~~ as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled to each other,

calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure, and a constrained direction with respect to the wiring structure at the constrained position as an initial value;

providing, to the initial shape, a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure;

calculating a predicted shape of the forcibly displaced wiring structure such that the provided condition is satisfied by utilizing a finite element method; and

outputting the calculated predicted shape.

~~(13) The method according to (12), wherein~~

~~information~~ Information concerning a change in the shape characteristic, the material characteristic and the constraining condition ~~is~~ can be provided to the outputted predicted shape,

a new predicted shape of the forcibly displaced wiring structure ~~is~~ can be calculated again by utilizing the finite element method, and

the new predicted shape ~~is~~ can be outputted ~~ed~~ again to enable ~~to verify~~ verification of an optimum shape of the wiring structure.

~~(14) The method according to (12), wherein~~

~~the~~ The wiring structure can be ~~is~~ a wire harness wired to a vehicle,

the constraining condition can be~~is~~ defined by coordinates of respective apexes of the plurality of beam elements and degrees of freedom at the respective apexes,

the shape characteristic can be ~~is~~ defined by a sectional area and a length of the beam element of the wiring structure, and

the material characteristic ~~is~~ can be defined by a moment of inertia, a polar moment of inertia, a density and a longitudinal modulus of elasticity and a transverse modulus of elasticity of the beam element.

~~(15)~~ According to yet another embodiment, ~~An~~ an apparatus for ~~of assisting a wiring design of~~ designing a wiring structure ~~in which the wiring structure constituted by a plurality of pieces of line streak members is regarded~~ represented as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method. The ~~, the~~ apparatus ~~comprising~~includes~~:~~

a setting unit for setting information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as the predetermined condition;

a calculating unit for calculating a predicted shape of the displaced wiring structure such that the condition is satisfied by applying the predetermined condition to the finite element method; and

an outputting unit for outputting the predicted shape calculated by the calculating unit.

~~(16) The apparatus according to (15), wherein the~~ The calculating unit can calculates the predicted shape where the wiring structure is forcibly displaced so as to satisfy the condition.

~~(17) The~~ The apparatus ~~according to (15)~~ further ~~comprising~~ includes a verifying unit which provides information concerning a change in the shape characteristic, the material characteristic and the constraining condition ~~to~~ for the predicted shaped output by the outputting unit, calculates again a new predicated shape of the forcibly displaced wiring structure by utilizing the finite element method and makes the outputting unit output the new calculated predicted shape to enable ~~to verify~~ verification of an optimum shape of the wiring structure.

~~(18) The apparatus according to (15), wherein t~~The calculating unit calculates strain and stress of the wiring structure, and the outputting unit outputs the calculated strain and stress together with the calculated predicted shape.

~~(19) The apparatus according to (15), wherein the~~ The calculating unit calculates reaction force and moment produced at a constraining point of the wiring structure, and the outputting unit outputs the calculated reaction force and moment together with the calculated predicted shape.

~~(20) The apparatus according to (15), wherein~~

The ~~the~~ calculating unit successively calculates states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition, and

the outputting unit successively outputs the calculated states of the wiring structure.

~~(21)~~ The apparatus ~~according~~ to (20) further ~~comprising~~ includes a second setting unit for setting a predetermined force ~~applies~~ applied to a predetermined portion of the wiring structure as the predetermined condition,

wherein the calculating unit successively calculates the deformation states of the wiring structure to which the force is applied, and the outputting unit successively updates and outputs the deformation state of the wiring structure based on the calculated deformation states of the wiring structure.

~~(22)~~ The apparatus ~~according to (20)~~ further ~~comprising~~ includes a temporary stopping unit for ~~temporary stop~~ temporarily stopping the output ~~by~~ of the outputting unit by a trigger based on a manual operation.

~~(23)~~ According to still another embodiment, ~~An~~ an apparatus for ~~of~~ assisting in designing ~~a wiring design of~~ a wiring structure ~~in which the wiring structure constituted by a plurality of pieces of line streak members~~ is ~~regarded~~ represented as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method., ~~the~~ The apparatus ~~comprising:~~ includes:

a first calculating unit for calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure and a constrained direction with respect to the wiring structure at the constrained position set as an initial value;

a setting unit for setting a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure to the initial shape;

a second calculating unit for calculating a predicated shape of the forcibly displaced wiring structure such that the set condition is satisfied by utilizing the finite element method; and

an outputting unit for outputting the predicted shape calculated by the second calculating unit.

~~(24)~~ The apparatus ~~according to (23)~~ further ~~comprising~~ includes a verifying unit which provides information concerning a change in the shape characteristic, the material characteristic and the constraining condition to the predicted shaped output by the outputting unit, calculates again a new predicated shape of the forcibly displaced wiring structure by utilizing the finite element method and makes the outputting unit output the new calculated predicted shape to enable ~~to verify~~ verification of an optimum shape of the wiring structure.

~~(25)~~ A recording medium ~~storing~~ stores a program which causes a computer to function as an apparatus for ~~of~~ assisting in the ~~wiring~~ design of a wiring structure ~~in which the wiring structure constituted by a plurality of pieces of line streak members~~ is ~~regarded~~ represented as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, the program causing the computer to ~~functions~~ function as:

a setting unit for setting information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as the predetermined condition;

a calculating unit for calculating a predicted shape of a ~~the~~ forcibly displaced wiring structure by applying the predetermined condition to the finite element method such that the condition is satisfied; and

an outputting unit for outputting the predicted shape calculated by the calculating unit.

~~(26) The recording medium according to (25), wherein the~~ calculating unit calculates the predicted shape where the wiring structure is forcibly displaced so as to satisfy the condition.

~~(27) The recording medium according to (25), wherein the~~ program causes the computer to calculate strain and stress of the wiring structure, and output the calculated strain and stress together with the calculated predicted shape.

~~(28) The recording medium according to (25), wherein the~~ program causes the computer to calculate reaction force and moment produced at a constraining point of the wiring structure, and output the calculated reaction force and moment together with the calculated predicted shape.

~~(29) The recording medium according to (25), wherein the~~ program causes the computer to successively calculate deformation states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition, and

successively update and output the deformation state of the wiring structure based on the calculated states of the wiring structure.

~~(30)~~ A recording medium ~~storing~~ stores a program which ~~cause~~ causes a computer to function as an apparatus of assisting in the ~~wiring~~ design of a wiring structure ~~in which the wiring structure constituted by a plurality of pieces of line streak members~~ is ~~regarded~~ represented as an elastic body which has a circular cross-section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, ~~the~~ The program causing the computer to function as:

a first calculating unit for calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure and a constrained direction with respect to the wiring structure at the constrained position set as an initial value;

a setting unit for setting a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure to the initial shape;

a second calculating unit for calculating a predicated shape of ~~the~~ a forcibly displaced wiring structure by utilizing the finite element method such that the set condition is satisfied; and

an outputting unit for outputting the predicted shape calculated by the second calculating unit.

~~(31)~~ —A method of assisting with a wiring design of a wiring structure by calculating a predicted shape concerning the ~~a~~ wiring structure ~~constituted by a plurality of pieces of line streak members, the~~ includes ~~method comprising~~ the steps of:

successively calculating deformation states of the wiring structure deformed from an arbitrary initial shape to a ~~finale~~ final shape; and

successively outputting the calculated states.

Please replace the paragraph beginning at page 19, line 14 with the following amended paragraph:

In Fig. 2, X-axis, Y-axis and Z-axis correspond to three axes orthogonal to each other in a right hand local coordinates system at respective node points (or also referred to as nodes) on the wire harness. Although for example, the Z-axis for a clip is made to coincide with a clip axis, a method of determining the axes can pertinently be changed in accordance with a function used. Further, in the drawing, constrained degrees of freedom of the branch point are also shown for reference. Further, a node point on the wire harness arbitrarily set other than the above-described constrained points is basically completely free although not illustrated here. The constrained degrees of freedom are respectively set to the respective nodes prior to calculating a predicted path, a reaction force or the like as described later.